The Claims

What is claimed as the invention is:

1. A method of generating hydrogen and oxygen gas comprising steps of:
injecting water molecules into a plasma to dissociate said molecules into a hydrogen species and an oxygen species;
separating within said plasma said hydrogen species from said oxygen species;
removing each of said oxygen species and said hydrogen species from said plasma so that said oxygen species forms gaseous oxygen and said hydrogen species forms gaseous hydrogen.

2. A method as set forth in Claim 1 further comprising the step of:
generating said plasma in the microwave frequency segment of the electromagnetic spectrum.

3. A method as set forth in Claim 1 further comprising the step of:
generating said plasma in the radio frequency segment of the electromagnetic spectrum.

4. A method as set forth in Claim 1 further comprising the step of:
generating said plasma from low frequency electromagnetic waves.

5. A method as set forth in Claim 1 further comprising the step of:
generating said plasma from an arc discharge.

6. A method as set forth in Claim 1 further comprising the step of:
developing an electromagnetic field from a source of electrical energy to define a plasma reaction zone, said water molecules being injected into said zone.

7. A method as set forth in Claim 6 further comprising the step of:

developing said electrical energy from at least one of solar energy, hydroelectric energy and geothermal energy.

8. A method as set forth in Claim 6 further comprising the steps of:
developing said electrical energy from a hydroelectric source; and
recovering at least a portion of water used by hydroelectric source as said injected water molecules.

9. A method as set forth in Claim 6 further comprising the steps of:
developing said electrical energy from a geothermal source in which water vapor is emitted; and
recovering at least a portion of said emitted water vapor as said injected water molecules.

10. A method as set forth in Claim 1 further comprising the step of recovering waste steam to provide said injected water molecules.

11. A method as set forth in Claim 1 wherein said injecting step includes the step of concurrently injecting a gas into said plasma.

12. A method as set forth in Claim 11 wherein said injecting step includes the step of injecting air into said plasma.

13. A method as set forth in Claim 11 wherein said injecting step includes the step of injecting nitrogen into said plasma.

14. A method as set forth in Claim 11 wherein said injecting step includes the step of injecting an inert gas into said plasma.

15. A method as set forth in Claim 14 wherein said inert gas injecting step includes injecting a selected one of xenon, neon, krypton, helium and argon into said plasma.

16. A method as set forth in Claim 1 wherein said injecting step includes the step of injecting steam into said plasma.

17. A method as set forth in Claim 1 wherein said separating step includes the step of placing a porous membrane adjacent said plasma wherein said porous membrane includes a plurality of pores having a diameter intermediate a diameter of said hydrogen species and said oxygen species such that said hydrogen species permeates through said membrane.

18. A method as set forth in Claim 17 wherein said placing step includes the steps of:

forming said porous membrane as a first tube;

placing said first tube within a nonporous second tube such that said reaction zone is confined between said first tube and said second tube, said water molecules being injected into said reaction zone from a first end of said second tube.

19. A method as set forth in Claim 17 wherein said placing step further includes placing a plurality of membranes in a selected one of a parallel and a serial arrangement.

20. A method as set forth in Claim 17 further comprising electrically biasing said membrane.

21. A method as set forth in Claim 20 wherein said biasing step includes the step of applying a DC voltage to said membrane.

22. A method as set forth in Claim 20 wherein said biasing step includes the step of applying an AC voltage to said membrane.

23. A method as set forth in Claim 22 wherein said applying step includes applying a high frequency voltage to said membrane.

24. A method as set forth in Claim 1 wherein said separating step includes the step of pumping said oxygen species and said hydrogen species through a converging diverging nozzle to form an exit beam wherein said oxygen species emerges from said nozzle substantially along a core of said beam and said hydrogen species migrates outwardly of said beam.

25. A method as set forth in Claim 24 wherein said converging diverging nozzle is a Laval nozzle.

26. A method as set forth in Claim 1 wherein said separating step includes the step of quenching of said oxygen species and said hydrogen species upon exiting said plasma to prevent recombination thereof.

27. A method a set forth in Claim 26 wherein said quenching step includes the step of pumping said oxygen species and said hydrogen species through an expansion nozzle prior to said shock cooling step.

28. A method as set forth in Claim 1 wherein said separating step includes the step of developing an electrical potential across said plasma wherein said potential interacts with a differing electrical potential of each of said hydrogen species and said oxygen species to effect separation.

29. A method as set forth in claim 1 wherein said separating step includes the step of developing a magnetic field across said plasma wherein said field interacts with a differing magnetic moment of each of said hydrogen species and said oxygen species to effect separation.

30. A method as set forth in Claim 29 wherein said separating step further includes the step of developing an electrical potential across said plasma wherein said potential interacts with a differing electrical potential of each of said hydrogen species and said oxygen species to effect separation.

31. A method as set forth in Claim 1 wherein said separating step includes the step of introducing a catalyst into said plasma to effect termination of the active species in each of said hydrogen species and said oxygen species.

32. A method as set forth in Claim 1 wherein said separating step includes the step of introducing a homogenous reactant into said plasma to react with said oxygen species to prevent recombination with said hydrogen species.

33. A method as set forth in Claim 32 wherein said introducing step includes the step of introducing carbon monoxide such that an OH intermediate combines with said carbon monoxide resulting in the production hydrogen atoms and carbon dioxide.

34. A method as set forth in Claim 1 wherein said separating step includes the step of introducing a sacrificial component into said plasma to react with said oxygen species to prevent recombination with said hydrogen species.

35. A method as set forth in Claim 34 wherein said introducing step includes the step of introducing carbon such that an OH intermediate combines with said carbon resulting in the production hydrogen atoms and carbon monoxide.

36. A method as set forth in Claim 1 wherein said separating step includes the step of introducing a atomic or molecular component into said plasma concurrently with said water molecules to inhibit recombination of said oxygen species and said hydrogen species

37. A method as set forth in Claim 36 wherein said introducing step includes the step of introducing iodine (I_2) into said plasma.

38. A method as set forth in Claim 1 wherein said separating step includes injecting a cryothermic gas selected to be non-reactive with one of said oxygen species and said hydrogen species into said plasma to shock cool said oxygen species and said hydrogen species to prevent recombination thereof.

39. A method as set forth in Claim 1 further comprising recovering energy from said plasma wherein said recovered energy is converted to a useful form.

37. A method as set forth in Claim 39 wherein said recovering step includes the step of inducing electrical current in electromagnets placed about said plasma from the electromagnetic energy of said plasma.

38. A method as set forth in Claim 39 wherein said recovering step includes the step of placing a heat exchanger proximal said plasma to recover heat energy therefrom.

39. A method as set forth in Claim 39 wherein said recovering step includes the step of placing a heat pipe within said plasma to recover heat energy therefrom.

40. A method as set forth in Claim 39 wherein said recovering step includes the step of placing solar cells proximal said plasma to recover light energy therefrom.

41. A method as set forth in Claim 39 wherein said recovering step includes the step of placing a thermoelectric device proximal said plasma to recover electrical energy therefrom.

42. A method as set forth in Claim 39 wherein said recovering step includes the step of placing a thermoionic device proximal said plasma to recover electrical energy therefrom.

43. A method as set forth in Claim 1 wherein said injecting step includes the step of injecting said water molecules in a first stream and further injecting an inert gas in a second stream, said first stream and said second stream having an angle therebetween ranging from 0° to 180°.

44. A method as set forth in Claim 1 wherein said plasma is a pulsed plasma.

45. A method as set forth in Claim 1 wherein said plasma is an oscillating plasma of having a controlled frequency.

46. A method as set forth in Claim 1 wherein said plasma is an oscillating plasma of having a variable frequency.

47. A method as set forth in Claim 1 wherein said plasma is developed at a pressure of between 1 mtorr to 1000 atmospheres.

49. A method as set forth in Claim 1 wherein said plasma is developed at a temperature between 5°C and 20,000°K.

50. A method as set forth in Claim 1 wherein said plasma is developed at a frequency between 50Hz and 100gHz.

51. A method as set forth in Claim 1 further comprising the step of introducing a seed material into said plasma to thereby lower the temperature thereof.

52. A method as set forth in Claim 1 wherein said introducing step includes the step of selecting said seed material from materials having low ionization potentials.

53. A method as set forth in Claim 52 wherein said selecting step includes the step of selecting from alkali and alkaline earth metals.

54. A method as set forth in Claim 52 wherein said seed material is mercury.

55. A method as set forth in Claim 1 wherein said removing step includes the step of introducing a catalyst into said plasma to terminate said oxygen species and said hydrogen species and to redirect said oxygen species and said hydrogen species to molecular hydrogen and molecular oxygen.

56. A method as set forth in Claim 55 wherein said catalyst has a high surface area.

57. A method as set forth in Claim 55 wherein said catalyst is silica gel.

58. A method as set forth in Claim 1wherein said injecting step further includes the steps of:

injecting nitrogen concurrently with said water molecules into said plasma such that nitric oxide is formed as a byproduct;

injecting an acid post plasma such that said nitric oxide reacts with said acid to form a salt thereby releasing molecular hydrogen.

59. A method as set forth in Claim 58 wherein said acid is phosphoric acid.